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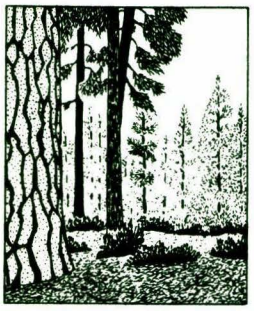

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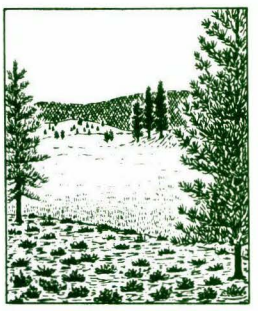

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EFFECT OF STORAGE TEMPERATURE ON VIABILITY OF SUGAR, JEFFREY, AND PONDEROSA PINE SEED

By
Gilbert H. Schubert, Forester,
Division of Forest Management Research

The effect of storage temperature on the viability of sugar, Jeffrey, and ponderosa pine seed was studied to determine a suitable condition for each of the three species. Barton 1/ has reported -4° C. (25° F.) as being better for ponderosa pine than either -11° C. or -18° C. (12° F. or 0° F.), but storage temperatures have not been recommended for either sugar or Jeffrey pine seed. Before 1952, all seed stored at this Experiment Station was kept in air-tight containers at 41° F. (5° C.). However, germination tests on some seed lots, particularly sugar pine, indicated that storage at 41° F. might not be the optimum temperature for all species. Results of the present storage test indicate that seeds of all three pines maintain higher viability when stored at temperatures lower than 41° F. and that the optimum temperature differs for each.

Methods

The seeds for this study were collected during September 1952. After the seeds were air-dried a sample of each species was used to determine the moisture content. The moisture contents, as a percent of oven-dry weight, were: Sugar pine, 9.5; Jeffrey pine, 5.4; and ponderosa pine, 5.1. Four half-gallon cans with tight lids were filled with seeds of each species. One can of seeds of each was placed in storage at 0° F., 23° F., 32° F., and 41° F.

Germination tests were conducted with fresh seed in the spring of 1953 and with stored seed in the summer of 1955. In 1953, 2 representative samples of 250 seeds of each species were stratified in moist vermiculite in gallon cans for 3 months at 36° F. In 1955, 2

1/ Barton, Lela V. 1954. Effect of subfreezing temperatures on viability of conifer seeds in storage. Boyce Thompson Inst. Contrib. 18: 21-24, illus.

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representative samples of 250 seeds from each storage temperature for each species were similarly stratified except that they were left in stratification for 5 months. The longer stratification period for the stored seed was necessary because of insufficient germinating flats. Therefore, the seeds were held in stratification an additional 2 months until the flats in use became available.

Germination counts were made at weekly intervals and continued until no further germination occurred. As the seedlings were counted, they were pulled out of the flats, examined, and then discarded.

Results

The germinative capacities of the fresh seeds were: Sugar pine, 98 percent; Jeffrey pine, 93 percent; and ponderosa pine, 86 percent. Most of the seed germinated during the first week--sugar pine, 90 percent; Jeffrey pine, 75 percent; and ponderosa pine 80 percent. By the end of the second week all of the sugar and ponderosa pine and 87 percent of the Jeffrey pine seed had germinated. The remaining 6 percent of the viable Jeffrey pine seed continued to germinate during the next 4 weeks.

At the time the stored seeds were removed from the 5-month stratification, most of the sugar pine seed which had been stored at 32° F. and lower had germinated. Some of the Jeffrey pine seed but very few of the ponderosa pine seeds also germinated while in stratification. The pregermination percentages were:

Storage temperatures:	Sugar pine	Jeffrey pine	Ponderosa pine
0° F.	86	21	4
23° F.	80	22	1
32° F.	66	20	1
41° F.	3	21	2

Most of the remaining seeds germinated during the first week, and all viable seeds of all three species had germinated by the end of the fourth week. The final germination percentages were:

Storage temperatures:	Sugar pine	Jeffrey pine	Ponderosa pine
0° F.	94	91	76
23° F.	84	93	78
32° F.	77	85	85
41° F.	6	84	76

The sugar pine seeds stored at 41° F. were covered with a thin layer of mold at the time they were removed from storage. After stratification both samples of these seeds were covered with a thick layer of mold and were all matted together. None of the sugar pine seed stored at the three lower temperatures, nor any seed of the other two species became moldy during the study period.

Sugar pine seed stored at 0° F., and possibly at 23° F., may not require as much as 3 months stratification to produce satisfactory germination. At the time the stored seeds were prepared for stratification, it was noted that the sugar pine seed stored at 0° F. were covered with small ice crystals. After the seeds had thawed at room temperature (approximately 70° F.), a few seeds were cut open. All endosperms and embryos were plump and moist. Therefore, a representative sample of 190 seeds were sown directly in a germinating flat without stratification. Since only 8 seeds germinated during the first 4 weeks, the flat was placed in the 36° F. refrigerator for 1 month. Within 2 weeks after removal from the refrigerator, 93 percent of the seeds germinated.

Summary and Discussion

Seeds of sugar, Jeffrey, and ponderosa pine were stored in half-gallon cans with tight lids at 4 temperatures--0° F., 23° F., 32° F., and 41° F. Best results were obtained for sugar pine at 0° F., for Jeffrey pine at 23° F., and for ponderosa pine at 32° F. Sugar pine seed stored at 41° F. lost almost all viability; however, for the other two species the difference between the best germination and that at 41° F. was only 9 percent. A heavy formation of mold on the sugar pine stored at 41° F. may be indicative of a too-high moisture content for seeds stored at that temperature.

Although not a part of the designed test, a stratification period of 5 months at 36° F. was found to be too long for both sugar and Jeffrey pine seeds. Approximately 90 percent of the viable sugar pine and 24 percent of the Jeffrey pine seed germinated while in stratification. Pregerminated seeds are unsuitable for direct seeding in the field or for sowing in the nursery because the radicles are too easily broken in handling the seed. A separate test indicated that sugar pine seed stored at 0° F. may require only a 1-month, rather than the usual 3-month stratification to produce satisfactory germination.

Further tests on the same seed lots will be continued in the 5th and 10th year of storage to determine the effects of storage temperatures after longer storage periods.